dem in fruſta confractum & auctionis lege venditum fuit, ita ut permulti eorum, qui adhuc in vivis ſunt, hujus rei oculati teſtes eſſe poſſint, & per conſequens nemo de hac circumſtantia, quod ſatis magna fruſta Ambræ reperiantur, dubitare debeat; hac occaſione ſemel adhuc quæro, qua ratione Americani Domini referentes cum ſua cyſtide hic convenient, ſi de tam ingentibus Ambræ gryſeæ fruſtis auditu vel lectu quicquam percipiunt?

Continuabitur hæc Diſſertatio in N° *ſeq.*

II. *An Account of a* new Engine for raiſing Water, *in which Horſes or other Animals draw without any loſs of Power (which has never yet been practiſed) and how the Strokes of the* Piſtons *may be made of any Length, to prevent the loſs of* Water, *by the too frequent opening of* Valves; *with many other Advantages altogether new; the Model of which was ſhewn to the* Royal Society *on the* 28th *of* November, *by* Walter Churchman, *the Inventor of it.*

The Deſcription *of this* Engine *is given on the Sides of the* Plate, *where the* Engine *itſelf is likewiſe delineated.* Vide Tab.

THE Animals all draw horizontally, and in a ſtreight Line, and at right Angles, whereby they exert their utmoſt Force. — By theſe Advantages

tages a far greater Power is gain'd from the Strength of Horſes, *&c.* than by their going round in a Circle; for by the Twiſt and Acuteneſs of the Angles, they draw in towards the Centre, whereby they waſte their Power, and alſo ſhorten their Levers: Beſides, their Muſcles and Tendons from their hinder Legs all along their Sides to their Necks are unequally ſtrain'd, as the Duty is hardeſt on one Side, even tho' their Walk is large. Therefore each of thoſe Inconveniencies muſt be attended with Pain to the Animals when at Work, and a great Loſs of their Strength.

2*dly*, A Crank does not riſe quite one third of its Circle, neither do the Regulators or Rods riſe or fall perpendicular, but obliquely, by which an oval Figure is made by the Piſton's Motion in every Cylinder, which occaſions great Friction and a loſs of Water, and every Arm of it is continually varying in its Power whilſt working, as its Lever is diſtant from the perpendicular Line, and two of the Arms (ſuppoſing it a quadruple one) as they croſs the Perpendicular are always drawing to, and from their own Centre, by which the Power is not only loſt, but the Time alſo; and farther yet, by the ſhortneſs of the Strokes, all the adjacent Water is frequently contrarily moved, and by the often opening and ſhutting of the Valves, there is alſo a great Waſte of the Water, beſides the many heavy Bearings, Frictions, Surges, and Repairs belonging to it; all which Inconveniencies and Impediment being thoroughly conſidered, there muſt certainly be required a much greater Power to work the ſame than by my Method. For, hereby, a

Stroke of 24 Feet will riſe, and by enlarging or diminiſhing the fix'd Wallower, you obtain a Stroke of any required Height, even to the extent of the Atmoſphere's Preſſure. By this great Advantage, the Water riſes freer, and with greater Velocity, and as the Lifters or Forcers riſe and fall exactly perpendicular, and with an equal continued Strain, and as the Bearings alſo are fewer and lighter, conſequently the Friction in all theſe will be a great deal leſs than with the Crank, *&c.* And, Laſtly, Seven Eights of that Water which is always loſt by the ſlow opening and ſhutting of the Valves will be ſaved.

From the above Conſiderations, and by the many Experiments I have made on this Occaſion, in order to know the real Difference between theſe different ways of Working, I find, that near twice the Quantity of Water will be raiſed to the ſame Height, in the ſame Time, with the ſame Power, by my Method, more than with the beſt Crank-work that has ever been yet erected.

A Perspective Vie

a.a.a.a. Is the great Frame. the ends of which under the Pine-Apples are to be contracted to the place of the little Frame, so that the Croſs piece at III may support ẏ 3 bearings now shewn in the little one, for a better view only.

b.b. The little frame on w^{ch} the Cap Braſses are, w^{ch} receive the turn'd T Gudgeons in the 3 Horizontal Shafts.

c.c. The Strong Supporters by the loose Wallowers.

d.d. The loose Wallowers whose turn'd rounds geer truly with ẏ Coggs in ẏ great Wheel.

e.e.e. The Regulator: w^{ch} has a Circular, direct, and retrograde Motion: see this in the Margins at Fig. 2&3

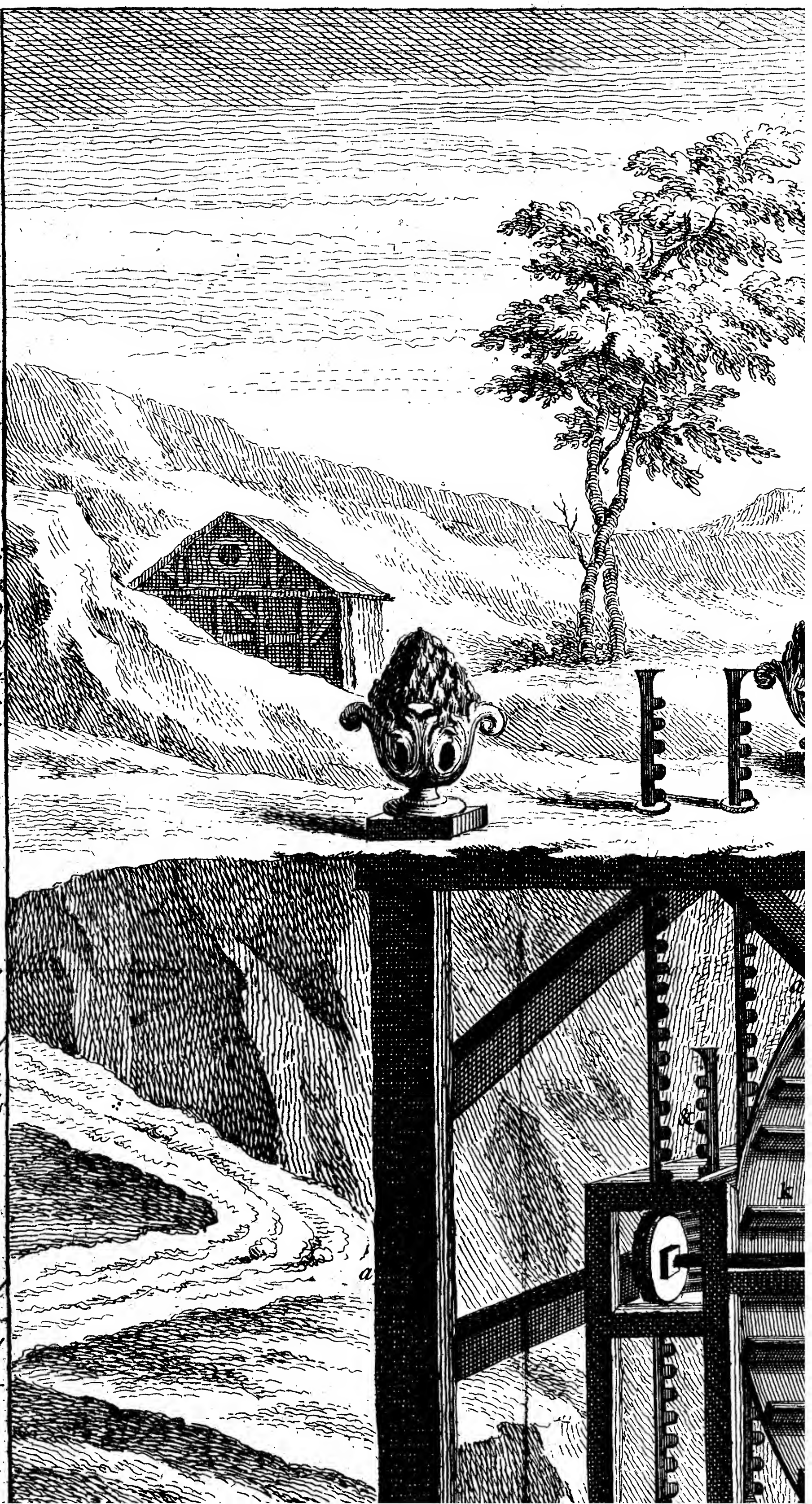
f.f. The Strong Shoulder or Stud fix'd to the Shaft close by ẏ Wallower: which Stops this loose Wallower: when ẏ end of ẏ regulator comes against it, thereby confining it for 2 Revolutions; after which it quits this Stud, & does the same on the opposite side of the Wheel, & so on Alternately, to reverse ẏ Motion of the Stems in the different Cylinders.

g.g. The Wheels, with their Coggs, which Alternately work ẏ fix'd Wallower lying between them.

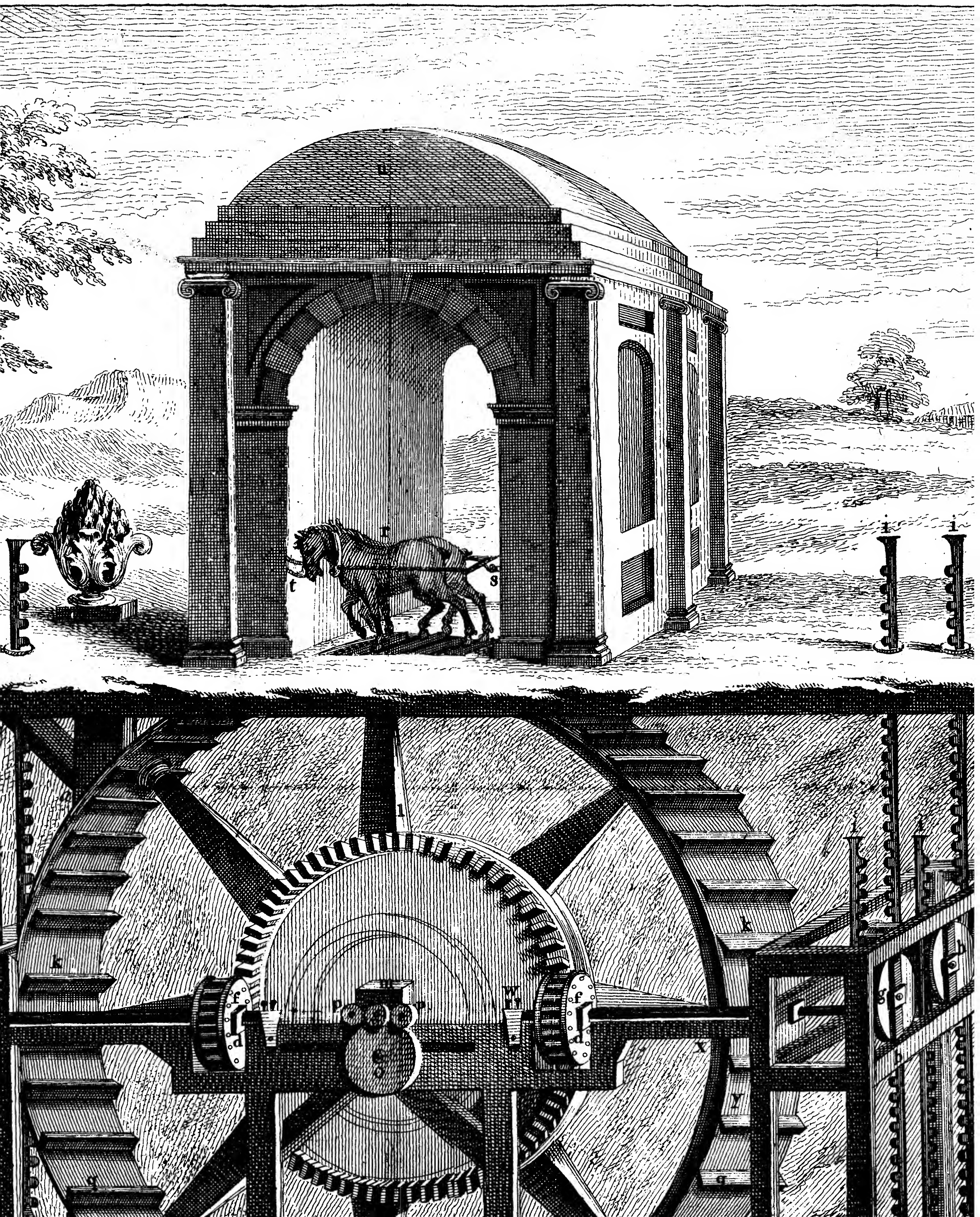
h. The fix'd Wallower suppos'd to be of four Feet in Diameter (on a very short Shaft) whose rounds must be of Cast soft Iron, & truly turn'd, to elevate & depreſs the Racks to ẏ Height of 24 Feet by its 2 Revolutions.

iiii. The 4 Lifters or forcers, behind each of w^{ch} must be a small Leverage back Wheel, truly fitted to direct the same to rise and fall easily & exactly perpendicular, to avoid friction & Loſs of Water in ẏ Cylinders.

k.k. The large vertical Wheel;

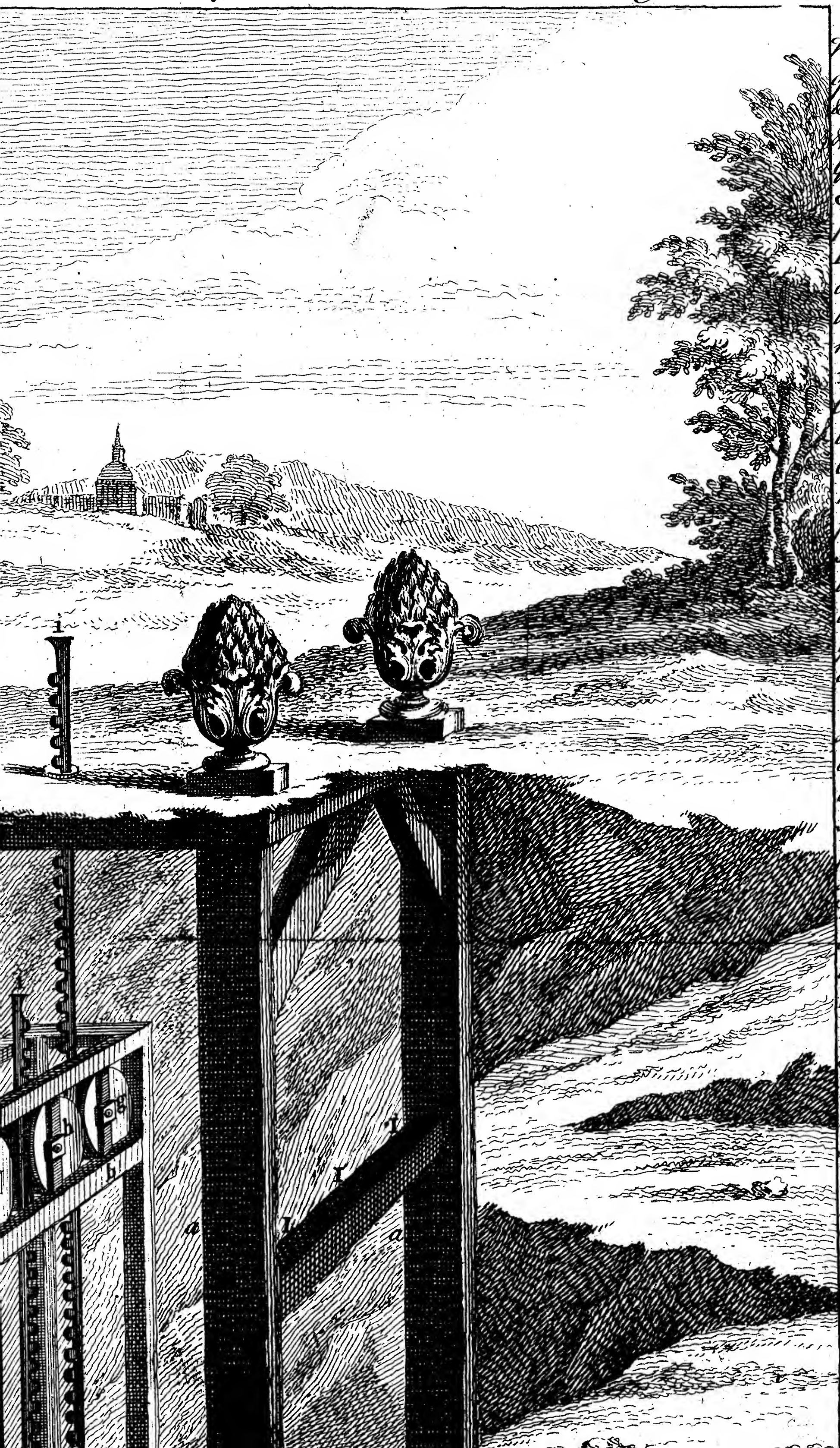


ew of M^{R}. CHURCHMAN'S ENG



Philos. Trans. Nº. 4

NGINE for raising Water.



p.p. Two small side Leverage—
Wheels exactly fitted to y^e turn'd par
of y^e great Gudgeon, between y^e Colla
& ſhoulder: they are to be ſo plac
& key'd, that their friction from y
Gudgeon may be alike when at Wo
q.q. The ſteps which the Horses fee
preſs, about 8 or 9 Inches broad, 2
Inches thick behind, & declining
an edge being design'd to make
level ground & good footing for the
hinder Leggs when they Draw.
r.r. 4 Horses only in view to avo
Confusion, all drawing Horizon
tally in a ſtreight line, & at righ
Angles, whereby these useful An
mals will soon be taught a new
pleasant way of working to the
selves, a more advantagious on
to their Masters, & of greater Uti
to y^e Publick. See my observations
y^e advantages of this Engine abo
others in y^e Philos. Transac. Nº. 4
s. The fastening places behind y
Horses, ſuppos'd to be ſtrong arm
below in y^e ſupporter, & a Croſs ba
above, at both of w^{ch} you may pla
small ſheeves or Rollers, y^e uppe
part of them to be level with eac
Horses breast (when drawing) & th
Rope or ſtrap to come over y^e sam
~~in order to keep a weight suspende~~
of £300 more or leſs one or two In
es from a Plank. By this Method
you will be exactly inform'd of y
ſtrength of each Horse, how long
it continues, & when to relieve hi
as Also when justly to correct y
ſlothfull one, whose weight res
ing on y^e Plank will always di
cover his Lazineſs.
t. The fastening places before t
ing design'd to direct their head
u. The Dome merely for Ornam
in y^e place of w^{ch} erect a Workloft
over y^t a horizontal Windmill:
y^e lower end of its upright ſhaf
fix a ſpur Wheel to work with t
Coggs of y^e great Wheel, thereby t

.N.º 434

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Ornam.ᵗ
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[illegible]
Water in y^e Cylinders.

k.k. The large vertical Wheel; a small Segment of which comes through y^e Floor in y^e Dome for y^e 4 Horses to stand & Draw on.

l.m. The arms, & y^e main Shaf

of the Same.

n. The turn'd T Gudgeon, with its Collar & Shoulder, both of w^{ch} must Clasp y^e rim of the under Leverage Wheel, to keep all firm & Steady when in working.

o. The leverage wheel of abou 4 feet in Diameter, with a Braſs or Iron rim suppos'd to be truly turn'd, and to have a Strong short Iron Spindle through its Center, & at each end a turn'd Steel Collar & Shoulder bearing on 2 Cast Cap Braſses exactly level, & sunk into a Strong Arch'd piece of Timber well braced and Supported for this purpose. ✱

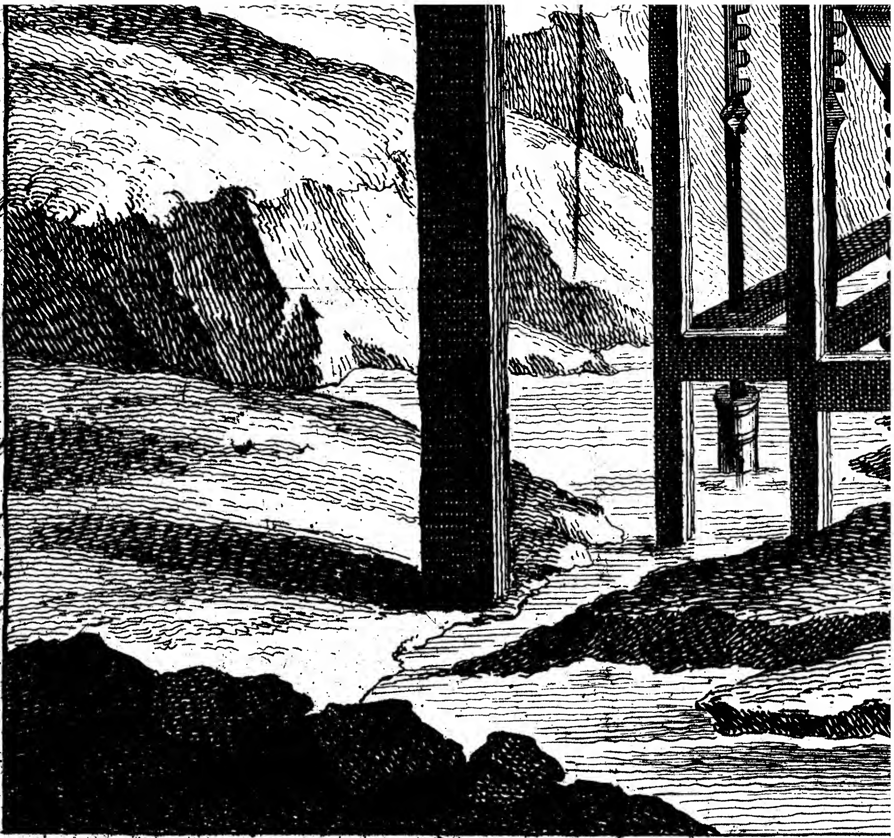
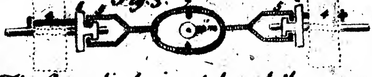


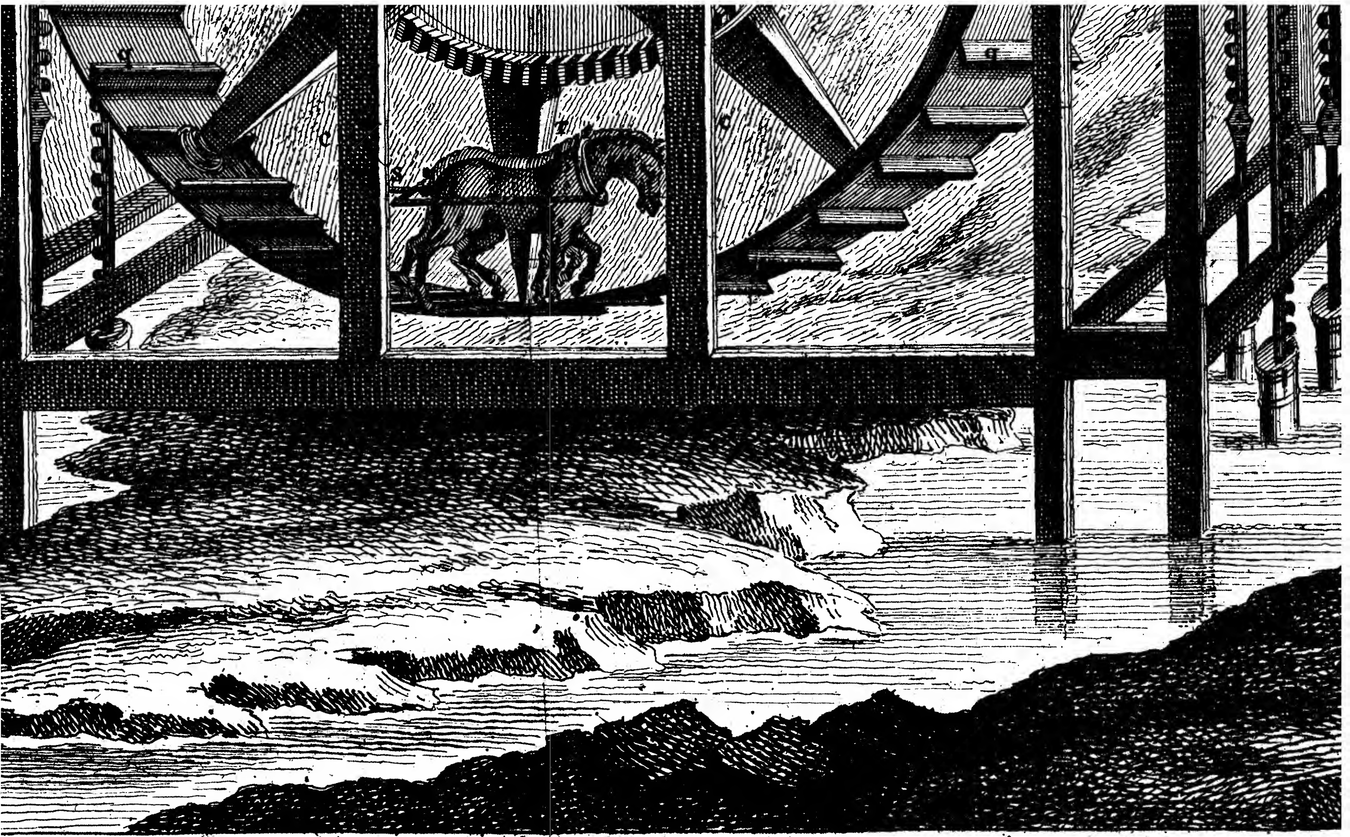
Fig. 3.



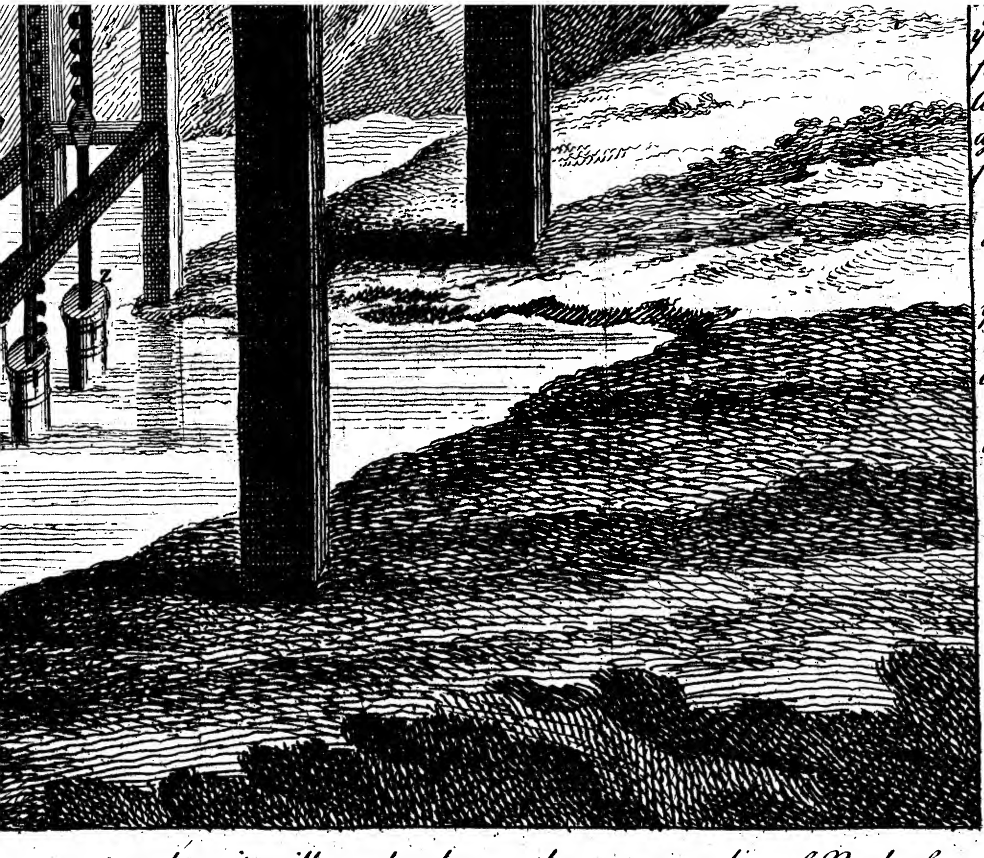
The Arms lie horizontal, and the oval part is perpendicular.

N.B. A single Shaft with the loose and fix'd Wallowers, w
lifting or forceing, at either of its ends, or at both together: but
purposes Vid. Fig. 2 in the Margin. The Pins 4.4

✱ In large Engines & Machines where the motion is regular every heavy bearing should have one of these Wheels



vers. will be of great simplicity and advanntage to the Publick. as being erected for leſs expence
er: but chiefly. as it is easily adapted to the different sorts of Windmills, Waterwheels, &c. of a
Pins 4,4, & the arms 55, which clasp the braſses 6,6.: with the oval figure 7 & it's 2 teeth make this Regulator,
e Wheels for, they save Power by greatly abating Frictionn. Upon the Principle of these Leverage=Wheels Captain Rowe ha



y^e lower end of its upright Shaft
fix a Spur Wheel to work with th
Coggs of y^e great Wheel, thereby to
aſsist y^e Horses, or w^n. there's a suffic
force of Wind to do their whole Duty

w. The Coupling Staples with
their Braſses:

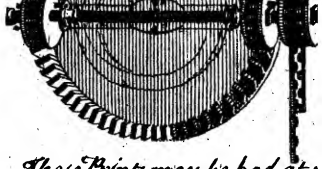
x. The Strong Catch w^{ch}. confin
y^e great Wheel to the Frame.

y. The Screw or Key-band to
confine all close & tight.

z. The Cylinders w^{ch}. are screw
together at their ends out of ſig

&. All y^e same sort of Work ch
ly for Uniformity in y^e Draug

Fig. 2.



expence, and as it will work pleasantly any number of Racks for
&c. of all denominations already in use. It also serves for ſmall
ulator, which is work'd by the Stud in the main Shaft ———
Rowe has publish'd what he calls his Friction Wheels tho ſubsequent to my Specification thereof.

These Prints may be had at
Chocolate=Warehouses
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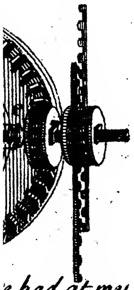

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Philos Trans [illegible]

A Perspective View of M^r CHURCHMAN'S ENGINE for raising Water.

aaaa Is the great Frame the ends of which under the Stone Apples are to be continued to the place of the little Frame so that the Cogs piece of [illegible] may support y^e bearings now shewn in the little one, for a better view only

bb The little frame on w^ch the large Brasses are w^ch receive the turned T Gudgeons on the Horizontal Shafts

cc The strong Supporters by the loose Wallowers

dd The loose Wallowers hollow turned round or truly with y^e Coggs on y^e great Wheel

ee The Regulator w^ch has a Circular direct and retrograde Motion as shewn in the Margin at Fig. 2

ff The Iron Shoulders or Studs fixed to the Shaft close by y^e Wallowers which stops the Wallowers when y^e end of y^e regulator comes against it thereby confining it for [illegible] Revolutions after which it quits this and does the same on the opposite side of the Wheel & so on Alternately to reverse y^e Motion of the Arms in the different Cylinders

gg The Wheels with their Cogs which Alternately work y^e fix'd Wallowers between them

h The fixed Wallowers supposed to be of four Feet in Diameter for a very short Stroke, whose rounds must be of cast Iron & accurately turned to alternately depress the Racks to y^e Height of 24 feet by its 2 Revolutions

iiii The 4 Pipes or forcers behind each of w^ch must be a small Brass cogg back Wheel truly pitched to direct the same to rise and fall easily & exactly perpendicular to avoid friction & loss of Water in y^e Cylinders

kk The large vertical Wheel a small segment of which comes through y^e Floor in y^e Dome for y^e Horses to stand & Draw on

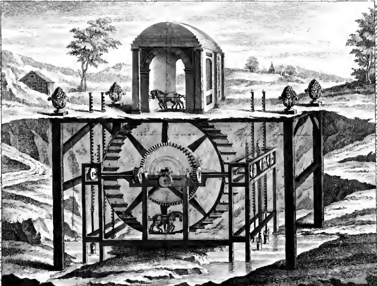
ll The arms & y^e main Shaft of the same

m The turned T Gudgeon with its Collar & Shoulder both of w^ch must Clasp y^e rim of the under Leverage Wheel to keep all firm & steady when in working

o The leverage wheel of about 4 feet in Diameter with a Brass or Iron rim supposed to be truly turned, and to have a strong short Iron Spindle through its Center & at each end a turned Steel Collar & Shoulder bearing on a Cast Cup Brasses exactly level & sunk into a strong Stand piece of Timber well braced and supported for this purpose.

Fig 1

The Arms lie horizontal and the goal part is perpendicular



yy Five small side Coverings ... Wheels exactly if that to y^e lower part of y^e great Gudgeon between y^e Roller & the Water they are to be sealed [illegible] that these fracture from y^e Gudgeon may be able when at Work.

qq The Steps which the Horses feet push about 3 or 4 Inches broad 2 Inches thick behind & declining to an edge being designed to make level ground & good footing for their hinder Legs when they Draw

rr 4 Horses only as are to avoid Confusion, all drawing Horizontally in a Straight line & at right Angles whereby these useful Animals will soon be taught a more pleasant way of working to them & also a more advantageous one to their Masters & of greater Utility to y^e Publick, for my observations on y^e advantages of this Engine above others see y^e Philos Transac N^o 434

s The fastening places behind y^e Horses supposed to be strong arms Iron on y^e Supporters & a cross bar above, in both of w^ch you may place small Rames or Rollers y^e upper part of them to be level with each Horses breast for then drawing & the Rope or Strap to come over y^e same in order to keep a weight suspended of 250 more or less one or two Inches from a Plank. By this Method you will be exactly informed of y^e Strength of each Horse how long it continued, which to relieve when, as Also when justly to correct y^e Slothful, one whose weight rests long on y^e Plank will always discover his Laziness

t The fastening places before being designed to direct their heads

u The Dome merely for Ornament in y^e place of w^ch erect a worklift over y^e horizontal Windmill or y^e lower end of its upright Shaft for a Spur Wheel to work with the Coggs of y^e great Wheel thereby to ease y^e Horses or w^ch throw a Sufficient Stream of Wind to do their whole Duty

w The Coupling Staples with their Braces

x The Strong Latch w^ch confines y^e great Wheel to the Frame

y Bandrons on Keyband to confine all close & tight

z The Cylinders w^ch are screw'd together at their ends overlaught

& All y^e same sort of Work chiefly for Uniformity in y^e Draught

Fig 2

N.B. A single Shaft with the loose and fix'd Wallowers will be of great simplicity and advantage to the Publick as being erected for less expence and as it will work pleasantly any number of Racks for lifting or forcing at either of its ends or at both together but chiefly as it is easily adapted to the different sorts of Windmills Waterwheels &c of all denominations already in use. It also serves for small purposes Vid Fig. 2 in the Margin —— The Pins q q & the arms ss which keep the bushes b b with the oval figure 7 & its 4 teeth make the Regulator e which is worked by the Stud on the main Shaft ——

As the large Engines & Machines where the motion is regular every heavy bearing should have one of these Wheels for they save Friction by greatly avoiding Friction. Upon the Principle of these Leverage Wheels [illegible] has published what he calls his Friction Wheels the subsequent to my Specifications thereof

These Prints may be had at my
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